“Six Sigma DMAIC in Transitioning from Petrol to Electric Motorcycle Production”
“A Data-Driven Study of Emissions and Performance”

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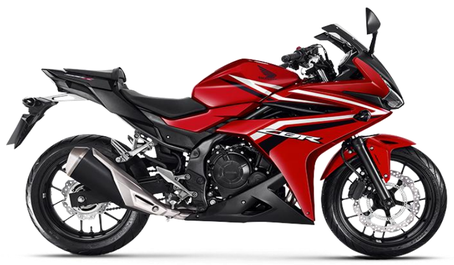

Research Aim

The research aims to facilitate a successful transition from petrol-powered to electric motorcycle production using the Six Sigma DMAIC framework.
This structured approach will help manufacturers:

- ✓ Improve manufacturing efficiency
- ✓ Reduce carbon emissions
- ✓ Maintain performance and quality standards throughout the transition

The study focuses on identifying challenges, analyzing performance gaps, and implementing sustainable improvements to streamline EV production while ensuring a viable economic model for manufacturers.

Background

Why Shift to Electric Motorcycles?
The motorcycle industry is under increasing pressure due to:

🌎 Climate Change Concerns – The transportation sector contributes significantly to CO_2 emissions, necessitating a shift to low-emission alternatives.

⚖️ Stricter Emissions Regulations – Governments worldwide are phasing out petrol vehicles and offering incentives for EV adoption.

Challenges in EV Manufacturing ?

🚧 Manufacturing Bottlenecks – Shifting from petrol to EV production requires significant process reconfiguration, including changes in assembly line infrastructure, automation, and quality control.

Background

🏭 High Initial Emissions in Production – While EVs produce zero tailpipe emissions, their manufacturing carbon footprint (mainly from battery production) is higher than petrol motorcycles.

⚙ Quality & Performance Concerns – New EV components (batteries, motors, power electronics) require rigorous quality assurance to match ICE motorcycles in reliability.

To address these challenges, this study adopts the Six Sigma DMAIC approach, a data-driven process improvement methodology to optimize the transition.

Objectives

This project supports motorcycle manufacturers in adapting to electric vehicle production by focusing on:

- ✅ Understanding Transition
- ✅ Baseline Production
- ✅ Identifying Issues & Root
- ✅ Developing Improvement
- ✅ Implementing & Sustaining Improvements.

METODOLOGY

Define → Measure → Analyze → Control

Key Findings (Efficiency, Emissions, Cost)

Efficiency & Quality

- ✓ Process optimizations reduced EV assembly time by 44%
- ✓ Early electric models had higher defect rates (5–7%) compared to petrol bikes (~3%)
- ✓ Six Sigma tools (real-time monitoring, AI defect detection) improved reliability

Cost & Economic Impact

- ✓ High upfront investment in equipment, R&D, and worker training
- ✓ Long-term savings offset costs through lower maintenance & operational expenses
- ✓ Projected cost parity between petrol & EV motorcycles by 2027
- ✓ Estimated ROI within 6–8 years

Emissions & Sustainability

- ✓ EV manufacturing currently emits 1.5× the CO_2 of petrol bike production (due to battery production)
- ✓ However, EVs achieve ~40% lower lifecycle greenhouse gas emissions per km than petrol bikes
- ✓ Sustainable battery manufacturing & renewable energy usage are crucial for reducing carbon footprint

Conclusion

This study shows that Six Sigma DMAIC offers a clear, data-driven path to shift from petrol to electric motorcycle production. By improving efficiency, quality, and emissions, manufacturers can achieve sustainable EV output without losing performance or profit. With smart planning and ongoing improvement, the transition can be smooth, competitive, and environmentally sound.